Rombough, Kyrik

From: Colin Campbell [campbell@rtpenv.com]
Sent: Tuesday, August 12, 2008 7:23 AM
To: Rombough, Kyrik
Subject: Hyperion air permit application - supplemental information

Mr. Rombough,

This email message presents additional information supplementing our PSD permit application submitted on December 20, 2007. This supplemental information is being provided as a follow-up to our discussion regarding emissions from the Gasification Flare during our meeting in Pierre on July 14-15, 2008. Specifically, we have reviewed and revised our emission estimates for gasification flaring events and have performed additional analysis of the feasibility of further reducing emissions from these events by recovering all off-specification syngas using a flare gas recovery system.

First, based on our review of the gasification flare emission estimates, we have determined that our prior estimate of VOC emissions was overly conservative. The VOC emission rates presented in Section 5.2.2.3 and in Appendix C to our initial permit application were based on an emission factor of 0.14 lb per million Btu (lb/MMBtu) heat input. This factor is presented in Table 13.5-1 of AP-42 (September 1991 ed.) and is based on a flared hydrocarbon stream comprising a mixture of propane and propylene. In contrast, the off-specification syngas that will be burned in the gasification flare at the HEC will contain less than 200 lb/hr of hydrocarbon, primarily methane. Accordingly, we now estimate that the potential VOC emissions from the flare are less than 4 lbs/hr and 0.4 tons/yr.

Second, based on our review of available measures to reduce emissions from flaring of off-specification syngas, we have concluded that there are no feasible control technologies for achieving greater emission reductions than those reflected in our permit application. In particular, we have confirmed that use of a flare gas recovery system to recover all off-specification syngas produced by the HEC gasification process is not technically feasible and that, even if it were technically feasible, it would not be economically feasible.

The flare gas recovery system for off-specification syngas is technically infeasible because of the adverse effects that it would have on the refinery fuel gas system, which is the only identified destination for recovered off-specification syngas. The short-term peak flow rate of off-specification syngas is approximately 1,500 MMBtu/hr and 4.8 million standard cubic feet (scf) per hour. This gas stream is greater than 85 percent hydrogen by volume and has a heat value of approximately 308 Btu/scf (HHV basis). By comparison, refinery fuel gas has a typical heat value of 1,255 Btu/scf (HHV basis). Hypothetically, if all refinery fuel gas-fired process heaters were operating simultaneously at 100 percent of capacity, the total refinery fuel gas flow rate would be 8,600 MMBtu/hr and 6.9 million scf/hr. At a more typically representative operating condition of 70 percent of capacity, the refinery fuel gas flow rate is 6,000 MMBtu/hr and 4.8 million scf/hr. If, at the start of the off-specification syngas flaring event, less than 1,500 MMBtu/hr of the refinery-wide fuel gas flow rate were being met by blending natural gas into the system, then the introduction of off-specification syngas would force the fuel gas system to vent to the refinery's emergency flares. If the natural gas flow rate were sufficiently high, then the off-specification syngas could theoretically be introduced into the fuel gas system without flaring. Although this design feature is theoretically possible, we do not consider it technically feasible due to the suddenness of this drastic change in fuel gas composition. The refinery fuel gas composition would immediately drop by at least 30 to 40 percent. (The diluted fuel gas would

have a heat value of 860 MMBtu/hr if all process heaters were operating at 100 percent of capacity, or to 780 MMBtu/hr at 70 percent of capacity.) In addition, even if it were technically feasible to accommodate this drastic and sudden change in the composition of gas in the refinery fuel gas system, addressing this possibility in the design of the low-NO_X burners to be used in all the process heaters at the HEC refinery would result in higher NO_X levels that would greatly outweigh the emission reduction achieved by flare gas recovery.

Finally, if the flare gas recovery system described above were technically feasible, it would have to include a compressor with sufficient capacity to handle the peak short-term flow rate of 4.8 million scf/hr. This system would have an installed cost well in excess of $100 million and an annual cost of more than $10 million/yr. This is an incremental cost effectiveness of approximately $400,000 per ton of CO, $20 million per ton of SO_2 emissions, and $30 million per ton of VOC.

Thank you for your attention to this matter.

Colin Campbell